TECHNICAL MEMORANDUM

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TO: Craig Goodings, Cumberland Resources Ltd.
DATE: March 02, 2006
FROM: Cameron Clayton
JOB NO: 05-1413-036A
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RE: **RESPONSE TO REQUEST BY ENVIRONMENT CANADA FOR ADDITIONAL INFORMATION – MEADOWBANK GOLD PROJECT**

On Wednesday, March 2nd, 2006 a teleconference call between representatives of Cumberland Resources Ltd (Cumberland), Environment Canada (EC), Golder Associates Ltd (Golder), and Azimuth Group Consulting (Azimuth) was conducted to discuss Environment Canada's Draft document of March 1, 2006 requesting additional information relating to Cumberland Resources Ltd.'s Meadowbank Project. The following responds to some of the information requests.

1.1 De-Watering of Lakes

EC has requested additional information regarding de-watering of the lakes. EC's rationale is presented below:

> *Environment Canada's Conclusion / Rationale*
> "Based on experience at the Ekati Mine, which dewatered lakes in preparation for open pit mining, drawdown of the lakes during summer resulted in much higher sediment concentrations in the water than when drawdown was done in winter. Even in winter, high suspended solids levels in the lake water limited the volume of water which could be discharged in compliance with licence discharge criteria. The FEIS does not have any contingency plans for clarification of water to be discharged, beyond what can be put in the tailings area (which will also have to be drawn down in advance of inputs) and attenuation ponds. EC feels that it is important to identify and evaluate any treatment in advance, given the potential for concerns with coagulants and flocculants which may be used.
>
> Phaser Lake will also be drawn down 1 m and this may expose unconsolidated sediments to wind and wave action which will be vulnerable to disturbance. Similar concerns may arise in the process of re-watering areas of lake sediments, such as the Vault lake bed. A contingency plan for maintaining water quality is needed.

> *Recommendations*
> "Development of contingency plans for treatment of turbid water during dewatering, or operational contingency plans, would be appropriate."

Information relating to this issue was presented previously in:

- Golder Associates Ltd., Technical Memorandum: Response to Kivialliq Inuit Associate Request for Additional Information, 09 February 2006; Section 1.3.

The above referenced document was provided by Golder to EC by email on 03 March 2006 to address this concern. For convenience, a portion of that document is summarized below:

> "Prior to the construction of the tailings dike, Second Portage Lake will require dewatering down to elevation 105 m Above Mean Sea Level (amsl) within the area bounded by the east dike. The total lake volume to a lake level elevation of 133 m amsl is estimated to be 12.8 Mm^3 within the area to the west of the East dike. The dewatering volume is estimated to be 12.2 Mm^3, excluding the volume of water contained below elevation 105 m amsl (~ 580,000 m^3). The quality of water pumped from each basin will be closely monitored to ensure that TSS loadings to Third Portage Lake from dewatering operations do not exceed the guideline criteria.
>
> Bathymetric data of Second Portage Lake indicates three separate basins; a Northwest Basin (~ 1.6 Mm^3), the Main Basin (~8.4 Mm^3), and an East basin (~ 2.5 Mm^3). Pool water will be withdrawn using pumps situated on a barge that is moored near the deepest portion of each basin to optimize withdrawal rate and minimize the risk of entraining sediment. In addition, silt curtains will be placed around the pumps to limit the uptake of TSS. With this approach it is anticipated that at about 60% of total pool water volume (~7.3 Mm^3) will be of suitable quality to permit direct discharge to Third Portage Lake without further TSS management. This estimate is consistant with other similar mining operations in the north requiring de-watering of mining areas (R. Eskelson, Diavik, pers. comm.).
>
> Where necessary, additional TSS management practices will be used to ensure pool water meets with discharge quality criteria prior to release to the environment. These practices include a reduction in pumping rates, and the installation of silt curtains and/or baffles in the vicinity of exposed beaches to increase the flow path and residency time within each basin. Alternatively, one or

more of the internal basins will be used as internal sedimentation ponds to provide temporary storage of pumped pool water until TSS criteria levels are achieved."

-From Golder Associates Ltd., Technical Memorandum: Response to Kivalliq Inuit Association Request for Additional Information, 09 February 2006; Section 1.3.

With respect to drawdown of Phaser Lake, during the teleconference call, Azimuth indicated that the shoreline exposed due to a 1 m drawdown would consist primarily of bouldery material; consequently, wind and wave disturbance of unconsolidated sediments is not expected.

1.2 Lake Sediment Removal

Environment Canada (EC) has requested additional clarification of disposal methods for lake bottom sediments to minimize the potential effects on surface waters. EC's rationale is presented below:

Environment Canada's Conclusion/Rationale
"Removal of lake bottom sediments will involve handling of saturated materials which are high in several metals (As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn), and having a fine clay/silt particle size. The relatively limited volume to be placed upstream of the tailings dike following excavation of the footing area should not significantly compromise supernatant quality. With respect to the balance of the lake bottom sediments, placement in the footprint of the Portage pit lake may represent a liability when the area is re-watered. Given the high metals content and fine particle size, it is unlikely that the sediments would be useful for terrestrial reclamation purposes. Consideration should be given to disposal to the bottom of the Portage pit prior to flooding, or other disposal methods where the materials will be effectively encapsulated."

Recommendations
"Options for disposal of lake bottom sediments should be refined and disposal methods developed that minimize the potential for effects on surface waters."

Information relating to this subject has been provided previously in the following documents:

- Golder Associates Ltd. February 9, 2006. Technical Memorandum: Response to Environment Canada Request for Additional Information.

- Golder Associates Ltd., September 26, 2005. Technical Memorandum: Item #28 and 28A – Meadowbank Gold Project – Storage Capacity of Tailings Impoundment and Materials Scheduling.

The following summarizes information presented in the above mentioned Technical Memorandum regarding the expected volume of soft sediments.

> "Currently there are limited data on the thickness of the soft sediments. The thickness is expected to be variable, and may range from a few centimetres up to several meters. Other projects in the north have reported soft sediments up to about 4 m in thickness in some areas, but lesser thicknesses in other areas. These sediments will need to be removed to beyond the footprint of the tailings dike and the open pits after the lakes have been drawn down. The following table summarizes estimates of the volumes of soft sediments that may need to be removed. At this time it is reasonable to assume an average thickness of 2 m for the lake bottom sediments.

Table 2: Estimate of Lake Bottom Sediment Volumes

	Approximate Stripping Area m^2	**Volume (assuming 1 m average thickness) m^3**	**Volume (assuming 2 m average thickness) m^3**
Tailings Dike	90,000	90,000	180,000
Goose Pit	200,000	200,000	400,000
Portage Pit (Includes Bay Zone and Connector Zone)	300,000	300,000	600,000
Total	590,000	590,000	1,180,000

Note: Volumes are based on plan areas of pits and dike below lake level where soft sediments may be present, and not on total footprint areas, and may differ from original waste management report due to modifications in dike location and pit size.

It is understood that Environment Canada has a concern that the re-watering of the pit areas will mobilize fine clays and silts which are indicated to be high in metals. It should be noted that it will be several years before the dikes are breached after the pits are re-flooded. Consequently, any fine sediments that have potentially been re-mobilized into the water column are expected to have settled out by the time the pit lake areas are reconnected to the surrounding lakes. The re-flooded pit areas will be modified where appropriate to increase the value of fish habitat according to the No Net Loss plan (see NNL, 2005), to satisfy DFO's requirements for no net loss of habitat.

It is noted that there may still be a requirement to place some of the fine sediments back into the pit prior to re-flooding in order to keep the top of the sediments at a depth of at least 2 m below the final lake level elevation to avoid disturbance due to wave action, wind, or ice. In this case, the sediments would be stripped as planned, and stock piled in the de-watered areas. The sediments will eventually freeze. At the end of mining, portions of the sediments would be placed back into the Portage Pit. Alternatively, portions of the sediments could be placed back into the pit as areas of the Portage Pit become available. This could be sequenced into the actual mine operations, so that the materials are placed into the base of the pit, and then subsequently covered by waste rock that may be placed back into the pit. This would encapsulate the fine sediments further, and reduce the potential for re-mobilization of these materials during pit re-watering.

1.3 Contingency Plan for Water Management Issues

The following responds to a request for additional information presented by Environment Canada regarding contingency planning for the management of water within the Attenuation Pond facility should water quality criteria preclude its discharge to Third Portage Lake. Information relating to this issue was presented previously in:

- Golder Associates Ltd., Technical Memorandum: Response to Kivalliq Inuit Associate Request for Additional Information, 09 February 2006; Section 1.7.

The above referenced document has been provided to EC on 03 March 2006, as supporting documentation to the following response.

During Years 1 to 4 of operations, the attenuation pond will receive the site contact water, including runoff and seepage from the waste rock disposal facility, treated runoff from the Portage and Goose Island pits, and runoff originating from the mill and airstrip areas. Any process (tailings-related) water will be contained in the reclaim pond located within the actual tailings impoundment area. The attenuation pond is sized to store the runoff volume from the 24-hour, 1:100-year storm event, in addition to its peak annual operating volume under average climate conditions. The attenuation basin has a capacity of approximately 800,000 m^3 until the construction of the stormwater dike is completed in Year 3, at which time its potential storage capacity will increase to 2.8 Mm^3 once the saddle dams are constructed. Water in the attenuation pond will be treated with lime, as required, and used to meet the process water demand or released to Third Portage Lake. If necessary, water within the attenuation ponds will be stored and treated in-situ to increase residency time and promote the settlement of solids. The treatment of ammonia in ponded environments was discussed in an AMEC memorandum dated October 12, 2005. A copy of the memorandum is provided in Appendix IX of the final October 2005 Mine Site Water Quality Predictions Report. However, should water quality not immediately meet discharge criteria then it will be directed to the reclaim pond in the main tailings facility. During this period of time, there will be excess capacity within the main tailings basin to accommodate storage of attenuation pond water that does not satisfy discharge criteria. At the end of Year 4, the mining of the Goose Island pit will be complete, and pit inflow water and site contact water will then be directed to the Goose Island pit.

1.4 Additional Questions by Email

The following additional questions were provided via email by Collette Spagnuolo of Environment Canada, on March 1, 2006.

1.4.1 Will sufficient geotechnical investigations be completed along the dike alignments so that we can be confident that there will be no concerns with the silt/clay sediments not being excavated?

The following geotechnical boreholes have been drilled along the dike alignments:

- Southeast De-watering dike: 7 geotechnical boreholes, including abutments
- Bay Zone Dike: 6 geotechnical boreholes, including abutments
- Goose Island Dike: 8 geotechnical boreholes, including abutments
- Tailings Dike: 5 geotechnical boreholes, including abutments

The geotechnical investigations have included sampling of overburden materials and subsequent engineering materials classification, Standard Penetration Testing in overburden, non-oriented and oriented rock core drilling and geotechnical logging, rock strength testing, hydraulic conductivity testing in rock and overburden, and thermistor installations in abutment boreholes. The data collected from these studies have been used in the evaluation of the stability of the de-watering dikes, and the tailings dike. The dikes are predicted to be stable under static and pseudo-static conditions, and for the long term. There is currently sufficient geotechnical data on which to base the dike feasibility designs.

Following the permitting process, it is expected that detailed engineering design studies will be implemented. Prior to the implementation of detailed engineering design, a ‘gap’ analysis will be carried out to identify any data deficiencies that may exist. The detailed engineering design studies will be designed to address data deficiencies that may be identified.

1.5 Have end-of-pipe effluent quality predictions been developed?

End of pipe effluent quality predictions have been provided in Appendices G (Mine Site Water Quality Predictions - Expected Case) and H (Mine Site Water Quality Predictions – Possible Poor-End Case) in tables G-6, G-7, H-6 and H-7. Tables G-6 and H-6 present water quality predictions for the Portage attenuation pond, based on a 2 m active layer thickness in the waste rock storage facility, while tables G-7 and H-7 present predictions based on an 8 m active layer thickness. For approximately the first 4 years of mine life, effluent discharge will be from the attenuation pond to Third Portage Lake. Then, after the attenuation and reclaim ponds merge, there will be no discharge to Third Portage Lake until the end of mine life, when water in the reclaim pond is treated to discharge guidelines and released. The quality of this reclaim pond water, predicted to be that of the last year (year 9), is presented in the above referenced appendices and tables under the heading "*Closure of Reclaim Pond (to water treatment)*".

1.6 In the Water Quality Predictions report, pages 3-2 and 3-3, inputs for ammonia are shown as 0 from the tailings. Is ammonia already accounted for elsewhere? Why aren't CN degradation amounts included?

At Meadowbank, ammonia is expected to come from the following two sources:

1. explosive residues from rock blasting, and
2. as a by-product of cyanide (CN) degradation.

Ammonia from explosive residues are accounted for in water quality predictions pertaining to the waste rock storage facilities and open pits, and ultimately reports to the Vault attenuation pond, and Portage attenuation pond during years 1 to 4. After this, there will be no discharge of attenuation pond water, as it will be re-routed to flood the pits. Ammonia from CN degradation is accounted for in the tailing reclaim water, which is not to be discharged until after treatment and at the end of mine life.

1.7 Will the Goose Pit be likely to develop a chemocline?

This question will be responded to by Golder under separate cover.

CJC/cjc
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